CLAIMS

What is claimed is:

1. A method for routing data within an optical network having a plurality of network nodes, the method comprising the steps of:

receiving data at a first network node via a first optical signal having a first wavelength, the first wavelength corresponding to a first optical frequency, the first optical frequency being mapped to a first binary representation, the first binary representation being divided into a first plurality of fields, at least one of the first plurality of fields corresponding to a routing label in a first label stack, a top routing label in the first label stack indicating a second network node; and

based at least partially upon the top routing label, transmitting the data from the first network node to the second network node via a second optical signal having a second wavelength.

2. The method as defined in claim 1, further comprising the step of:

popping the top routing label off the first label stack so as to promote a next routing label in the first label stack.

3. The method as defined in claim 2, wherein the second wavelength corresponds to a second optical frequency, the second optical frequency being mapped to a second binary representation, the second binary representation being divided into a second plurality of fields, at least one of the second plurality of fields corresponding to a routing label in a second label stack, a top routing label in the second label stack indicating a third network node.

4. The method as defined in claim 3, wherein the top routing label in the second label stack corresponds to the next routing label in the first label stack.

5. The method as defined in claim 4, wherein the network accommodates 2^N frequencies in the form of,

$$f_i = f_0 + i \cdot \Delta f$$

wherein $i = 0, 1, \ldots 2^N - 1$, wherein the second optical frequency is defined by,

$$f_{i_{out}} = f_0 + 2^L\left(\left(f_{i_{in}} - f_0\right) - 2^{N-L} l \Delta f\right)$$

and,

$$i_{out} = 2^L\left(i_{in} - 2^{N-L} l\right)$$

wherein $f_{i_{in}}$ represents the first optical frequency, l represents the value of the top routing label in the first label stack, and L represents the bit length of the top routing label in the first label stack.

6. The method as defined in claim 1, further comprising the step of:

swapping the top routing label in the first label stack with a new routing label when the first label stack contains more than two routing labels.

7. The method as defined in claim 6, wherein the second wavelength corresponds to a second optical frequency, the

second optical frequency being mapped to a second binary representation, the second binary representation being divided into a second plurality of fields, at least one of the second plurality of fields corresponding to a routing label in a second label stack, a top routing label in the second label stack indicating a third network node.

8. The method as defined in claim 7, wherein the top routing label in the second label stack corresponds to the new routing label.

9. The method as defined in claim 8, wherein the network accommodates 2^N frequencies in the form of,

$$f_i = f_0 + i \cdot \Delta f$$

wherein $i = 0, 1, \ldots 2^N - 1$, wherein the second optical frequency is defined by,

$$f_{i_{out}} = f_{i_{in}} + 2^{N-L}\left(l - l^1\right)\Delta f$$

and,

$$i_{out} = i_{in} + 2^{N-L}\left(l - l^1\right)$$

wherein fi_{in} represents the first optical frequency, l^1

represents the value of the top routing label in the first label stack, l represents the value of the new routing label, and L represents the bit length of the top routing label in the first label stack.

10. The method as defined in claim 1, further comprising the step of:

pushing a new routing label onto the first label stack.

11. The method as defined in claim 10, wherein the second wavelength corresponds to a second optical frequency, the second optical frequency being mapped to a second binary representation, the second binary representation being divided into a second plurality of fields, at least one of the second plurality of fields corresponding to a routing label in a second label stack, a top routing label in the second label stack indicating a third network node.

12. The method as defined in claim 11, wherein the top routing label in the second label stack corresponds to the new routing label.

13. The method as defined in claim 12, wherein the network accommodates 2^N frequencies in the form of,

$$f_i = f_0 + i \cdot \Delta f$$

wherein $i = 0, 1, \ldots 2^N - 1$, wherein the second optical frequency is defined by,

$$f_{i_{out}} = f_0 + \left\lfloor \frac{(f_{i_{in}} - f_0)}{\Delta f} \right\rfloor . 2^{-L} . \Delta f + 2^{N-L} l \Delta f$$

and,

$$i_{out} = \left\lfloor \frac{i_{in}}{2^L} \right\rfloor + 2^{N-L} l$$

wherein fi_{in} represents the first optical frequency, l represents the value of the top routing label in the second label stack, and L represents the bit length of the top routing label in the second label stack.

14. The method as defined in claim 1, wherein the first wavelength is the different from the second wavelength.

15. The method as defined in claim 1, wherein the first wavelength is the same as the second wavelength.

16. The method as defined in claim 1, wherein at least another one of the first plurality of fields corresponds to a termination field indicating an end of the first label stack.

17. The method as defined in claim 1, wherein at least another one of the first plurality of fields corresponds to a contention field for differentiating the first wavelength from a third wavelength.

18. The method as defined in claim 17, wherein the data is a first data, wherein second data is received at the first network node via a third optical signal having the third wavelength, and wherein the first optical signal and the third optical signal have similar routing paths through the network.

19. An apparatus for routing data within an optical network having a plurality of network nodes, the apparatus comprising:

an optical receiver for receiving data at a first network node via a first optical signal having a first wavelength, the first wavelength corresponding to a first optical frequency, the first optical frequency being mapped to a first binary representation, the first binary representation being divided into a first plurality of fields, at least one of the first plurality of fields corresponding to a routing label in a first label stack, a top routing label in the first label stack indicating a second network node; and

an optical transmitter for transmitting, based at least partially upon the top routing label, the data from the first network node to the second network node via a second optical signal having a second wavelength.

20. The apparatus as defined in claim 19, wherein the first wavelength is the different from the second wavelength.

21. The apparatus as defined in claim 19, wherein the first wavelength is the same as the second wavelength.

22. The apparatus as defined in claim 19, wherein at least another one of the first plurality of fields corresponds to a termination field indicating an end of the first label stack.

23. The apparatus as defined in claim 19, wherein at least another one of the first plurality of fields corresponds to a contention field for differentiating the first wavelength from a third wavelength.

24. The apparatus as defined in claim 23, wherein the data is a first data, wherein second data is received at the first network node via a third optical signal having the third wavelength, and wherein the first optical signal and the third optical signal have similar routing paths through the network.